Interest rate spread and financial crisis

**The Behaviour of Interest Rate Spreads Prior to and After the Financial Crisis: Evidence across OECD countries**

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**Abstract**

This study investigates the impact of the 2008 global financial crisis on interest rate spreads across OECD countries, using a number of panel methodological approaches, over the 1990-2015 period. We examine the differential impact of the global financial crisis on interest rate spreads by dividing the sample period into two, i.e. the period prior to and after the crisis. Having identified and estimated the impact of a number of drivers on interest rate spreads, the findings document that after the 2008 financial crisis, the sensitivity of spreads to its determinants turn out to be statistically significant and incorporate credit risk to a greater extent. The findings survive a number of robustness checks. The policy implications of the empirical findings are also discussed.

**Keywords**: interest rate spreads; financial crisis; panel data; OECD countries

**JEL Classification**: E43; G21; C33

**1. Introduction**

Interest rate spreads, or the difference between lending and borrowing rates, are important indicators of banking system efficiency. Wide interest rate spreads discourage savings through low interest rates on deposits, while they restrict lending for investment. This in turn, can adversely affect economic growth. The potential dangers of rising interest rate spreads have received greater attention following the 2008 financial crisis. In the past, economists believed that widening interest rate spreads were a problem only confronted by developing countries, because these countries did not possess appropriate regulations and frameworks governing the operation of their banking system (Brock and Rojas-Suarez, 2000, Hanson and De Resende Rocha, 1986). The financial crisis, however, documented that high interest rate spreads was not only a problem faced by developing, but also by developed economies. The spreads for example, rose rapidly in the U.S., the U.K. and Europe in the period after the crisis (Taylor and Williams, 2009).

The present study extends the literature by exploring for the first time, whether the factors that drive interest rate spreads have changed after the 2008 financial crisis. The analysis makes use of a sample across OECD countries, given that these countries, especially, the U.S and Europe, were those that were worst hit by this crisis event. Low borrowing rates between 2003–2006, accompanied by capital inflows and new banking products which led to the credit boom in the U.S, had severe consequences for the OECD countries. A question arises as to whether these low interest rates by European Central Banks were influenced by the decisions of the U.S. or whether the low interest rates were due to the interdependence between central banks that caused global short rates to be lower than what they otherwise might have been (Taylor, 2008). According to Taylor (2008), the financial crisis became severe in August 2007, when the money market interest rates rose significantly. The sharp reduction in Central Bank rates in response to the crisis further contributed to the widening of the spreads in the period after the crisis. The number of bank failures in many OECD nations skyrocketed during this period; for example, Colonial Bank, Guaranty Bank, Cal National Bank (U.S), Lloyds (UK), Landsbanki, Glitnir (Iceland), to name a few. In Ireland, one of its three largest banks, Anglo Irish Bank, was nationalized, and the other two, Allied Irish Bank and Bank of Ireland were re-capitalized. In response to this, banks tightened lending rates and restricted lending which also contributed to the widening of the spreads in the same period. Similar arguments were put forward by Friedman and Schwartz (1963) with regard to the Great Depression of the 1930s. They attributed the depression to both contractionary monetary shocks and banking panics. However, the movement of the nominal interest rates following the depression was downward.

While prior studies have investigated the efficiency of the financial system by focusing on net interest margins (Demirguc-Kunt and Huizinga, 1999, Drakos 2003, Kasman et al. 2010), very few studies have been undertaken on interest rate spreads. Agapova and McNulty (2016) in a study of the relationship between interest rate margins and banking efficiency, argue that net interest margins may not be the best measure of the efficiency of a banking system because it is an ex-post measure, rather than an ex-ante measure. Moreover, net interest margins are affected by both the asset and the liability composition of banks, as well as the volume of non-performing loans (Agapova and McNulty, 2016). Therefore, for empirical purposes this study focuses on interest rate spreads.

While there is a large literature on factors that can trigger a financial crisis, such as business cycles (Mitchell 1941), banking panics (Friedman and Schwartz (1963), falling asset prices, failures of financial and non-financial firms and deflations (Minsky, 1972; Kindleberger, 1978), lack of liquidity (Alan and Carletti, 2008), and capital mobility (Reinhart and Rogoff, 2008), there is hardly any literature on how exactly a crisis affects interest rate spreads. According to theoretical arguments, credit spreads usually increase during financial crises, because such crises are associated with higher default rates and greater risk premia (Demirguc–Kunt and Detragiache, 1997). There is also a literature which examines the effect of various variables on interest rate spreads (Brock and Rojas Suarez, 2000; Fuentes and Basch, 1997; Barajas, 1999; Hanson and De Resende Rocha, 1986; Hanweck and Ryu, 2005). However, the emphasis of the studies by Brock and Rojas Suarez (2000), Fuentes and Basch (1997) and Barajas (1999) has been on banks from the Latin American region[[1]](#footnote-1). Ho and Saunders (1981) present a theoretical model of bank spreads in which a bank would always have an interest spread due to transactions uncertainty. They highlight that the spread is a function of the degree of managerial risk aversion, the size of transactions undertaken by the bank, the bank market structure, and the variability of interest rates. A number of extensions have been made to the Ho-Saunders model. Allen (1988) extends the Ho and Saunders model to incorporate loan heterogeneity, while Angbazo (1997) incorporates the effect of management efficiency. Following from the above discussion, this paper investigates the following question:

*Are the factors that influenced interest rate spreads prior to the crisis the same as those that affected these spreads after the crisis?*

After the financial crisis, reducing the spread became a major objective of monetary policy. Investigating the factors that influence interest rate spreads is important because these spreads affect not only the transmission mechanism of monetary policy, but also the cost of loans. Answering this question, therefore, is important for policy makers in order to take appropriate action to minimize the spread in the event of a future crisis, as the cost of rescuing banks can be very high. Many central banks in the developed world have emphasized an enhanced role for regulation after the financial crisis.

We also use robustness checks to explore the validity of the baseline findings in a number of ways: investigating the before and after the financial crisis period, adding more control variables to capture a range of possible alternative venues of influences on interest rate spreads, employing different estimation methodologies, including the system GMM methodology that corrects for any potential endogeneity bias, as well as Pesaran’s (2006) estimation methodology with a multifactor error structure, where the unobserved common factors are correlated with exogenously given individual-specific regressors, and where factor loadings change over the cross section units. Moreover, given the uncertainty and likely measurement errors in interest rate spreads, the robustness of the results are also tested using the net interest margin (NIM) as an additional measure. The financial crisis also highlighted that agency problems could undermine the soundness of the banking system, leading to weak governance systems which, in turn, can lead to excessive risk taking and fraudulent practices in the banking system (De Andres and Vallelado, 2008). The importance of agency costs when there is a separation between ownership and control were first highlighted by Jensen (1976) and Jensen and Meckling (1976). Their findings were subsequently supported by Ang et al. (2000), among others, who found that agency costs increased when a company was managed by an outsider. As agency costs could increase in a crisis environment due to higher risk taking, we also investigate, as part of the robustness checks, how agency costs could affect interest rate spreads. Following Doukas et al. (2005), McKnight and Weir (2009), Mensah and Abor (2014), and Belghitara and Clark (2015), agency costs in the present study are first measured as the audit fees plus directors' fees (agency cost) expressed over total assets of the bank (agency). In other words, the employed definition of agency costs focuses on the managerial actions associated with the banks’ performance. According to Jensen and Meckling (1976), auditors are agents of the shareholders whose interests are considered different from those of the managers of the companies audited. Finally, the robustness analysis additionally attempts to capture the regulatory environment by using the measure of bank reserve requirements and rule of law (La Porta et al. 1997, 1998; Levine 1997). The data span the period 1990-2015. The results suggest that after the financial crisis, bank-specific factors have played a more important role in determining interest rate spreads in the OECD countries under study.

The rest of this paper is structured as follows. Section 2 presents the data and methodology, while Section 3 evaluates the empirical results. Section 4 provides a number of robustness checks and, finally, Section 5 concludes.

**2. Data and Methodology**

***2.1 Data***

The data comprise a balanced panel for 35 OECD countries (the countries can be seen in the appendix), spanning the period 1990-2015. The dependent variable, interest rate spreads, is the interest rate charged by banks on loans to private sector customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits. The deposit rate is the rate paid by commercial or similar banks for demand, time, or savings deposits, while the lending rate is the bank rate that usually meets the short- and medium-term financing needs of the private sector. This rate is normally differentiated, according to creditworthiness of borrowers and objectives of financing (World Bank, 2016). Data on these spreads are taken from the Federal Reserve Bank of St. Louis, the World Development Indicators and the European Central Bank Statistical Warehouse. As a robustness check, the analysis also uses the net interest margin (NIM), interest income minus interest expenses scaled over total assets (Garza-García, 2010) as a proxy for interest rate spreads. The NIM is also a good standard measure of the profitability of a bank’s essential business.

A number of independent variables to capture banking sector soundness are also included in the empirical analysis: the bank capital to asset ratio (Demirguc-Kunt and Huizinga, 1998; Brock and Rojas-Suarez, 2000; Entrop et al., 2012; Navajas and Thegeya, 2013), bank non-performing loans to total gross loans (Barajas et al., 1999), and liquid assets to total assets (Brock and Rojas-Suarez, 2000). The last variables proxy liquidity risk, since a bank with higher liquidity faces lower liquidity risk and is likely to be associated with lower spreads due to a lower liquidity premium charged on its loans. Banks with high risk usually borrow emergency funds at high costs and thus charge a liquidity premium, leading to higher spreads (Ahokpossi, 2013). Furthermore, a weak macro-economic environment could lead to higher systemic risk. Demirguc-Kunt and Detragiache (1998) argue that low GDP growth and high inflation, all increase the probability of systemic risk. Gambacorta (2004) argues that changes in monetary policy can additionally affect both deposit and lending rates through the interest rate, bank lending and bank capital channels. In the case of monetary policy tightening, policy rates rise and, thus, short-term interest rates make it more costly for banks to get sufficient funding; in that sense, they pass these costs onto borrowers through higher lending rates. The bank lending channel works through the moral hazard and adverse selection mechanisms; hence, following a monetary tightening, interest rates increase and banks attract more risky customers, so as in order to compensate for the higher risk they increase their lending rates. In other words, the presence of certain frictions in the financial markets make internal and external sources of finance not to be perfect substitutes of each other (in contrast with the theory by Modigliani-Miller), but there is a gap between the costs of internal (e.g., retained earnings) and external financing (e.g., issuing equity or debt), which is called the external finance premium. Monetary policy can influence the external finance premium in a manner that monetary tightening increases and monetary loosening decreases its magnitude. Due to this additional effect of monetary policy on the external finance premium, the impact of monetary policy on the cost of borrowing may be amplified (Bernanke and Gertler, 1995). According to this approach, banks may decide to smooth or not their interest rates, hereby reducing or enhancing the effect of monetary policy. Adverse selection and moral hazard problems may induce banks to increase their loan interest rates at a smaller or larger extent than the rise in their cost of funding due to monetary tightening. Hence, it is ambiguous whether the banking system amplifies or weakens the functioning of monetary policy. It depends on which mechanism dominates in the economy. The net effect of the banking sector depends on certain characteristics of the banking system (i.e., the degree of competition, easy access to external financing of firms and banks, etc), as well as on certain characteristics of the economy (i.e., the distribution of good and risky borrowers and the relevance of adverse selection behaviour).

Both the rate of inflation, measured by the consumer price index (CPI) and the GDP growth rate are also used in the analysis, while the risk premium on lending, as measured by the interest rate charged by banks on loans to private sector customers minus the ‘risk free’ treasury bill interest rate at which short-term government securities are issued or traded in the market, is also used. In some countries interest rate spreads may be negative, indicating that the market considers its best corporate clients to be at lower risk than the government. Claims on central governments include loans to central government institutions, net of deposits. The data are on an aggregate country basis and are obtained from the Orbisbank (ex Bankscope) dataset.

The financial crisis illustrated that agency problems could undermine the stability of the banking system resulting from weak governance systems which favour excessive risk taking and fraudulent practices in the banking system (De Andres and Vallelado, 2008). Hence, the analysis also incorporates a variable for agency costs, measured as audit fees plus directors' fees (agency costs), expressed over total assets of the bank, as part of a robustness check. The relevant data are also obtained from the Orbis dataset. A higher ratio indicates that managers achieve their personal goals at the expense of the goals of the investors. In order to maintain the soundness of the banking system, banks are required to maintain a certain reserve ratio. Finally, in order to capture the regulatory environment, the analysis initially employs bank reserve requirements as a further robustness check. The opportunity cost of holding reserves is that a bank can otherwise earn a profit by lending these funds out (Mishkin and Eakins, 2012). We also use the rule of law as an independent variable as it is found to affect banking sector efficiency ((La Porta et al. 1997, 1998; Levine 1997). These data are obtained from Bloomberg. Table 1 provides a number of descriptive statistics.

**[Insert Table 1 about here]**

***2.2 Methodology***

First, two second-generation panel unit root tests are employed to determine the degree of integration in the respective variables. The Pesaran (2007) panel unit root test does not require the estimation of factor loading to eliminate cross-sectional dependence. Specifically, the usual ADF regression yields (Pesaran, 2007):

Δyit = ai + bi yi,t-1 + uit

where, yit is the observation on the ith cross-section unit at time t and uit denotes the error term, which has the single-factor structure: uit = γi ft + εit, in which ft is the unobserved common effect, and εit is the individual-specific (idiosyncratic) error. This ADF regression has been augmented to include the lagged cross-sectional mean and its first difference to capture the cross-sectional dependence that arises through a single-factor model:

\_ \_

Δyit = ai + bi yi,t-1 + ci yt-1 + di Δyt + εit

with a bar above a variable denoting its mean value. The null hypothesis is a unit root for the Pesaran (2007) test. Moreover, the bootstrap panel unit root tests by Smith et al. (2004) utilize a sieve sampling scheme to account for both the time series and cross-sectional dependence in the data through bootstrap blocks. All four tests by Smith et al. (2004) are constructed with a unit root under the null hypothesis and heterogeneous autoregressive roots under the alternative hypothesis. The results of these panel unit root tests, reported in Table 2, support of the presence of a unit root across all variables under consideration, except in the cases of spreads and the risk premium on lending.

**[Insert Table 2 about here]**

The empirical analysis is carried out through the panel GMM approach. The following model is applied:spreadsit = αi + β xit’ + εit

where xit is a k-dimensional vector of explanatory variables, while αi captures effects of factors associated with the ith bank and that are constant overtime. In the fixed effects model, αi represents fixed parameters. The GMM methodology avoids potential endogeneity and is based on the approach recommended by Arrelano and Bover (1995) and Blundell and Bond (1998). The Hansen test for overidentification can be used to check the validity of instruments, while a two-step system GMM provides more efficient estimators over one-step system GMM. Moreover, two-step GMM gives robust Hansen J-test for over-identification.

A Lagrange Multiplier (LM) panel unit root test developed by Im et al. (2005) is also used to test for a structural break. Lee and Strazicich (2003), suggested a panel LM t-statistic. Lee and Strazicich’s model can be recalled as follows:

Δyit = γi’ΔΖit + δi Ŝi(t-1) + εit

where Δ is the first difference operator, Ŝi(t-1) is the detrended variable of Yit, and εit denotes an error term. The t-statistic (denoted t\*) for the null hypothesis H0: δi=0 can be calculated for each unit in order to compute the following LM test statistic:

N

t\* = 1/N Σti\*

i=1

This in turn can be used to determine the following standardized panel LM test statistic:

LM(ṯ) = [√N(ṯ-E(ṯ)] / [√V(ṯ)]

where E(ṯ) and V(ṯ) are tabulated by Im et al. (2005). The results reported in Table 4 are based on the break date identified by this test which is 2008.

As part of the robustness check procedure, the analysis also makes use of the Persaran’s (2006) estimation methodology for heterogenous panels with a multifactor error structure. This methodology allows for the estimation of panel data models with a multifactor error structure, where the unobserved common factors are (possibly) correlated with exogenously given individual-specific regressors, while the factor loadings change over the cross section units. This methodology permits filtering the individual-specific regressors by weighted cross-section aggregates, such that asymptotically, as the cross-section dimension (N) goes to infinity, the differential effects of unobserved common factors are removed. This procedure has the advantage of being estimated by OLS applied to an auxiliary regression where the observed regressors are weighted by cross sectional averages of the dependent variable and the individual specific regressors (Pesaran, 2006).

**3. Empirical results**

Table 3 reports the preliminary results using the two-step system GMM methodology. Column one reports results without the macroeconomic variables, while column two illustrates results with the inclusion of these variables. Capital adequacy exerts a negative effect on interest rate spreads, indicating that higher bank growth levels are achieved with lower lending rates, while the banks could potentially possess additional sources of financing that increase credit activity, as well as reducing the price of loans. Higher liquid assets have a negative effect on spreads, indicating that banks are likely to receive lower interest rate income, which leads to lower spreads, given that their deposit markets are sufficiently competitive (Bikker, 2003). The positive and significant coefficient on non-performing loans highlight that a higher volume of non-performing loans lead to wider interest rate spreads. A higher volume of non-performing loans would require higher lending rates to make up for losses, leading to greater risks in lending. Barajas et al. (1999) similarly find that nonperforming loans play a significant role in contributing to the widening of interest spreads, suggesting that banks need to set aside additional resources to cope with bad loan problems. The relationship between spreads and the risk premium on lending is positive, which is explained by the banks’ attempts to maintain profit margins, when probably faced with high levels of non-performing loans which could be attributed to tighter monetary conditions. In other words, bad debt provisions, associated with rising credit risks, indicate that banks keep lending rates high as they charge higher risk premia to maintain their profitability. The results seem to support the relevant arguments put forward by Kashyap and Stein (2000) and Aspachs et al. (2005). Finally, in terms of the macroeconomic variables, GDP growth exerts a negative impact on spreads, indicating that more favourable economic conditions lower the probability of default and raise the value of the collateral, leading to reduced lending rates. Moreover, higher inflation cause banks to increase their interest rates to maintain the real value of their profit margins, while higher inflation is often an indicator of enhanced economic uncertainty, for which the banks seek compensation via higher spreads (Hanson and de Rezende Rocha, 1986).

All the relevant diagnostics are reported in the bottom part of Table 3. For the validity of the instruments, the results need to reject the test for second-order autocorrelation, AR(2) in disturbances. Moreover, they need to reject the null hypothesis of difference-in-Hansen tests of the exogeneity of instruments. It is evident that both the test for AR(2) of disturbances and the difference-in-Hansen tests fail to reject the respective nulls. Thus, these tests support the validity of the instruments used, while difference-in-Hansen tests imply exogeneity of our instruments. The table also reports the Hansen test for overidentifying restrictions. In the estimation process, 24 instruments have been used in the two specifications. These instruments were generated as we use two lags for levels and three lags for difference in the regressors. As the number of instruments was by far lower than the number of observations, it did not create any identification problem as reflected in the Hansen test.

**[Insert Table 3 about here]**

In the following step, the analysis repeats the estimation methodology by splitting the sample at 2008, the year that signified the beginning of the financial crisis. According to Borrio (2009), this financial crisis event exacerbated any potential weaknesses on the asset side of banks’ balance sheets, which triggered certain funding problems. Such strains exposed growing problems in the quality of the underlying assets leading to asset sales, which accelerated declines in asset prices and resulted in further balance sheet pressures. This in turn, fed on imbalances in bank funding structures such as excessive recourse to debt financing, reflected in high degrees of leverage. Such characteristics led to severe dislocations in bank funding, large off-balance sheet exposures and high interest rate spreads (Laeven and Valencia, 2008; Reinhart and Rogoff, 2008; Karim et al., 2012).

This part of the empirical analysis suggests the employment of the Lagrange Multiplier (LM) panel unit root test developed by Im et al. (2005). Based on a univariate LM statistic, Lee and Strazicich (2003), suggested a panel LM t-statistic, as explained above in the Data section. The results are reported in Table 4. The LM test documents that there is one significant break date, i.e. at 2008.

**[Insert Table 4 about here]**

Finally, the split estimates are reported in Table 5 with the results including all variables being reported. The findings with respect to the bank-related variables document an interesting picture. In particular, the bank capital ratio retains its sign over both regimes, but it is significantly stronger over the period after the crisis. A similar picture is emerging in relevance to the non-performing loans ratio, i.e. it is statistically insignificant over the period prior to the 2008 financial crisis, while it turned strongly significant (at the 1% level) over the period after the crisis, as well as in relevance to the risk premium on lending, which was statistically significant at the 10% level prior to the financial crisis regime and turned out to be strongly significant (at the 1% level) in the period after the crisis. In terms of the liquidity ratio, the significance remained strong over both regimes, while a similar picture emerged with respect to both macroeconomic variables, i.e. inflation and GDP growth. The statistical significance of the equality of all coefficients across the two regimes clearly highlights the differential impact of all coefficients on interest rate spreads between the two periods examined. Overall, the results illustrate that mainly bank-specific factors seem to play a more important role in determining interest rate spreads across OECD countries, mainly after the 2008 crisis period. Such findings clearly provide evidence that the banking sector, especially with respect to lending activities, has turned into a more uncertain environment as this is reflected on the higher sensitivity of such spreads to its determinants.

**[Insert Table 5 about here]**

**4. Robustness checks**

*4.1. A different definition of interest rate spreads*

The first part of the robustness analysis makes use of the net interest rate margin, that is, interest income minus the interest expenses scaled over total assets (NIM) (Garza-García, 2010). The NIM is measured by the ex-post approach and is viewed as a good standard measure of the profitability of banks’ essential business. A higher margin could mean an exceptional management across banks in the same form of business, while lower margins suggest a very low deposit rate and higher costs of borrowing.

The new split estimates are reported in Table 6. The new findings illustrate a similar picture to that presented in Table 5. In particular, both the bank capital ratio and the non-performing loans ratio are stronger and statistically significant over the period after the 2008 financial crisis. A similar picture is also described with respect to the risk premium on lending, which turns to be statistically significant at the 1% level in the period after the crisis. In terms of the liquidity ratio, the significance remains strong over both regimes, while this is also true for both macroeconomic variables, i.e. inflation and GDP growth, Overall, the results illustrate that regardless of the definition of interest-rate spreads, the bank-specific drivers play a more significant role in determining interest rate spreads across OECD countries after the 2008 crisis. Finally, statistical testing on the equality of all coefficients across the two regimes confirms again the differential impact of all coefficients on interest rate spreads between the two periods under study.

**[Insert Table 6 about here]**

*4.2. A different methodological approach*

In the presence of cross-section error dependence, conventional panel estimation methods could lead to inconsistent estimates and incorrect inferences. In our framework, this issue is of great importance because cross-section dependencies are likely to be present for a variety of reasons, such as omitted common factors (Pesaran and Tosetti, 2011). In order to take into account the cross-sectional dependence, this part of the robustness checks implements the novel econometric methodology suggested by Pesaran (2006).

The new results (based on the interest-rate spreads measured as the difference between deposit and lending rates) are reported in Table 7, across both the financial crisis regimes and they document the presence of a similar picture to that reported in Table 5. Once again, the role of the 2008 financial crisis is catalytic in exemplifying the role of the banking specific variables in determining interest rate spreads, primarily over the period after the crisis event, given that statistically the null hypothesis on the equality of all coefficients across the two regimes is rejected.

**[Insert Table 7 about here]**

*4.3. The role of agency costs*

According to the agency problem, there is clear evidence on the separation of ownership and management, which indicates that the interests of shareholders and management are not in tandem (Fama, 1980; Jensen, 1976; Jensen and Meckling 1976). More specifically, managers are concerned with their job security and avoid risk-taking (Hirshleifer and Thakor, 1992) since they are unable to nature their unemployment risk. By contrast, shareholders have larger incentives and are able to diversify their risk by having a number of portfolios (Demsetz and Lehn, 1985). To minimize the impact of the agency problem, there is the need for shareholders to monitor the activities of the managers (Mensah and Abor, 2014). Especially after the recent financial crisis, the role of the stability of the banking system in the process of economic growth across the globe has been further appreciated. As a part of this stability target, the role of the agency problem seems to have gained further significance. This happens because agency problems could lead to weak governance systems that primarily favour excessive risks taking, disregard rules of prudent lending, and adopt insider abuses and fraudulent practices in the banking systems. These problems seem to be exacerbated by issues in relevance to the presence of asymmetric information (De Andres and Vallelado, 2008). Therefore, this part of the empirical analysis explores any potential impact of agency cost metrics on bank interest rate spreads across our OECD country sample. Given that managerial (agency) costs come with a cost to the owners, this could potentially explain why there is the likelihood of reduction in the residual value accrued to shareholders (owners). Therefore, in trying to minimize the agency problem, there is the need for these shareholders to monitor the works of the managers, thereby, spending money through this monitoring (Mensah and Abor, 2014), which could lead to higher interest rate spreads. In other words, a positive sign is expected out of the estimation procedure.

Given data availability, the agency cost variable is measured as audit fees plus directors' fees (agency cost) expressed over total assets of the bank (Agency). The data in the numerator are obtained from the Orbis (ex Bankscope) dataset. A higher ratio is an indication that managers, in achieving their personal goals, tend to neglect the goals of the investors. This is a symptom of agency problems, since shareholders expect wealth maximization. Mensah and Abor (2014) indicate that this variable impacts banks' spreads in a positive manner. The new results are reported in Table 8. They clearly illustrate not only the positive impact of the agency costs variable on interest-rate spreads, potentially due to a more stressful banking environment, but also that the role of the bank-specific variables turns out again to be highly stronger after the 2008 financial crisis, thus, providing further robust support to the findings presented in Table 5.

**[Insert Table 8 about here]**

Table 8a repeats the estimates reported in Table 8, but this time following the recommendation by a referee and the approach recommended by Mensah and Abon (2014), the agency costs variable is expressed in terms of the number of non-executive directors scaled over the total board size. According to De Andres et al. (2005), the board size has to be a mixture between the characteristics of a large board, knowledge and resources, and effective communication and coordination that characterizes smaller boards. The aspect of independent directors is particular important in the agency theory, because it assumes that being outside of the organization makes sure that there is no other conflict of interest between the agent and the principal, which increases the likelihood of corrective actions. It is, therefore, expected a negative relationship between this variable and interest rate spreads. The results confirm the negative impact of the alternative definition of the agency costs variable on interest-rate spreads, despite the presence of a more stressful banking environment, indicating that the presence of this environment has not weakened the role of outside members of the board in forming the risk profile of banks. At the same time, the bank-specific variables retain their stronger role after the 2008 financial crisis, thus, providing more robust support to the findings presented in Table 5.

**[Insert Table 8a about here]**

*4.4. The role of the regulatory environment*

In this final part of the robustness checks section, we attempt to explore the role of the regulatory environment prior to and after the 2008 crisis. In general, banks maintain a certain percentage of their deposits with the Central Bank and in that respect they charge higher margins as compensation (Maudos and De Guevara, 2004). Though these reserves are used by the central banks to safeguard the soundness of the banking system, they tend to reduce the potential revenues the banks could enjoy, which is an extra cost to them (Grenade, 2007). As a response, banks can pass this cost to their customers in two ways: (i) by giving lower deposit rates, and (ii) by charging higher lending rates. This is expected to widen the interest spreads. Poghosyan (2012) assesses the impact of regulatory (among others) factors on interest-rate spreads for the case of low-income countries. His findings highlight that bank capitalization substantially account for the variation in interest spreads, where lower bank capitalization leads to higher spreads.

To the empirical needs of this part of the analysis, we employ a regulatory variable measured as bank reserve requirements (Reserves). This variable is measured as the reserves of banks with the central banks scaled over total assets, with data being obtained from Bloomberg. This measure is used as a fiscal policy instrument to support the soundness of the banking system, albeit it is considered as a cost driver for banks. Maudos and De Guevara (2004) and Maudos and Solís (2009) provide supporting evidence that reserve requirements represent an opportunity cost to the banks, and therefore, they increase their profitability margins, while Mensah and Abor (2014) also confirm their results. It is, therefore, expected that an increase in banks’ reserves requirements will lead to higher interest rate spreads. These findings are reported in Table 9 and they document that higher reserves lead to higher interest spreads. Although the association is positive and statistically significant, the effect turns out to be stronger over the period after the 2008 crisis. The remaining explanatory drivers display the same picture as that presented in Table 5, with statistical testing on the equality of all coefficients across the two regimes confirming the differential impact of all coefficients on interest rate spreads across the two regimes under study.

**[Insert Table 9 about here]**

Finally, following the reviewer’s recommendation, the analysis repeats the estimates reported in Table 9, by measuring the regulatory measures as the Rules of Law (LAW). A number of studies find that legal institutions have a strong influence on banking environment, especially in relevance to their risk-taking behaviour (Cole and Turk, 2013; Houston et al., 2010). To consider this definition, we follow the recommendation by La Porta et al. (1997, 1998), Levine (1997) and the above references and we include the Rule of Law variable into the estimated regression as a proxy of the regulatory framework. The Rule of Law measures the extent to which agents have confidence in and abide by the rules of society, the quality of contract enforcements, the police, and the courts and the likelihood of crime and violence. In this case, a negative effect of the LAW variable on interest rate spreads is expected. Data on the Rules of Law were obtained both from Kaufmann et al. (2011) and the World Bank database, while Table 10 reports these new estimates. They highlight that a safer regulatory environment leads to lower interest spreads. However, this negative effect on interest rate spreads turns out to be weaker over the period after the 2008 crisis. Finally, the remaining explanatory drivers display the same picture as that reported in Table 9, with statistical testing on the equality of all coefficients across the two regimes rejecting the null hypothesis of the homogeneous impact of all coefficients on interest rate spreads across the two regimes under study.

**[Insert Table 10 about here]**

**5. Conclusion and policy implications**

This study attempts to understand the drivers of interest rate spreads before and after the 2008 financial crisis. A large literature documents the importance of a well-functioning financial sector for economic growth. This was evidenced by the financial crisis and its impact on the global economy. The findings of this study could have important implications for interest rate spreads and, more generally, for the implementation of monetary policy, especially during stressful banking environments. The findings demonstrate the strong interconnection between the 2008 financial crises and bank interest rate spreads across banks in OECD countries. More specifically, the results indicate that in the period after the crisis, interest rate spreads became more sensitive to their determinants. These findings survive a number of robustness checks.

The results suggest that credit risk has been better priced into spreads after the crisis. After the financial crisis, regulators have paid greater attention to the risk profile of banking institutions, while these institutions themselves have been encouraged to pay greater attention to their risk management activities. As a response, a number of measures have been introduced to minimize credit risk through screening, monitoring, long-term customer relations, higher capital adequacy requirements, better liquidity provisions and collateral, among other measures (Mishkin and Eakins, 2012). The finding that spreads turn out to be more sensitive to their drivers in the period after the crisis are potentially due to the increased transparency brought about by tighter regulations which have led both banks and investors to reach better credit decisions. The lesson at the end of the day is that banks’ business models should be adequately based on more stable sources of funding, such as retail deposits, longer-term funding and, most importantly, equity. In addition, the findings exemplify a potential role for monetary authorities to improve macroeconomic stability that reduces uncertainty, adopt an institutional framework that strengthen bank balance sheets via more aggressive debt collections, writing off non-performing assets, eliminating connected and directed lending, better regulation and supervision, increasing competition across banking institutions, and improving economic institutions, particularly, ensuring clear property rights, appropriate collateral regimes, compilation of credit history, and strong contract enforcement.

Potential venues for future research involve the employment of a bank-based disaggregated analysis that could potentially include the role of the size of the banks, and whether interest rate spreads differ between private and state-owned banks. Finally, the investigation could be further expanded to other country blocks as well, especially to those in developing countries.

**Appendix:** Country list

Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Latvia, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, U.K., U.S.

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Table 1. Descriptive statistics

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variable Mean S.D. Min Max Jarque-Bera

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Spread 4.592 18.339 -1.372 541.631 [0.000]

Bank capital to

asset ratio 6.922 2.488 2.400 24.000 [0.000]

Non-performing

loans to total

gross loans 4.501 5.256 0.082 34.672 [0.000]

Liquid assets to

total assets 30.784 18.284 0.000 151.950 [0.000]

Risk premium

on lending 3.262 2.117 -1.607 15.578 [0.000]

NIM 1.458 2.416 0.613 2.157 [0.000]

Agency 0.219 0.484 0.128 0.284 [0.000]

Reserves 0.064 0.025 0.051 0.069 [0.000]

log(cpi) 1.887 0.267 -1.173 2.165 [0.001]

log(gdp) 11.557 0.678 7.878 13.219 [0.000]

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Notes: The Jarque-Bera test is asymptotically distributed as a chi-square distribution with 2 degrees of freedom. Figures in brackets denote p-values.

Table 2. Panel unit root tests

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Pesaran** | **Pesaran** | **Smith et al. t-test** | **Smith et al. LM-test** | **Smith et al. max-test** | **Smith et al. min-test** |
| **CIPS** | **CIPS\*** |
| spreads | -5.22\*\*\* | -5.36\*\*\* | -5.20\*\*\* | 23.15\*\*\* | -6.61\*\*\* | 6.34\*\*\* |
| Bank capital to assets ratio | -1.28 | -1.37 | -1.29 | 2.91 | -1.49 | 1.28 |
| ΔBank capital to assets ratio | -5.69\*\*\* | -5.38\*\*\* | -6.81\*\*\* | 22.18\*\*\* | -7.37\*\*\* | 7.20\*\*\* |
| Non-performing loans to total gross loans | -1.22 | -1.27 | -1.39 | 3.14 | -1.45 | 1.29 |
| ΔNon-performing loans to total gross loans | -5.28\*\*\* | -5.53\*\*\* | -6.69\*\*\* | 20.81\*\*\* | -7.84\*\*\* | 7.29\*\*\* |
| Liquid assets to  total assets | -1.26 | -1.34 | -1.44 | 2.83 | -1.48 | 1.36 |
| ΔLiquid assets to  total assets | -5.41\*\*\* | -5.60\*\*\* | -6.83\*\*\* | 23.19\*\*\* | -7.62\*\*\* | 7.88\*\*\* |
| Risk premium  on lending | -5.72\*\*\* | -5.91\*\*\* | -6.94\*\*\* | 22.27\*\*\* | -7.58\*\*\* | -7.81\*\*\* |
| NIM | -1.34 | -1.42 | -1.33 | 2.84 | -1.35 | 1.39 |
| ΔNIM | -5.43\*\*\* | -5.72\*\*\* | -5.61\*\*\* | 21.97\*\*\* | -6.94\*\*\* | 6.84\*\*\* |
| log(cpi) | -1.30 | -1.39 | -1.28 | 2.66 | -1.39 | 1.42 |
|  |  |  |  |  |  |  |
| Δlog(cpi) | -5.61\*\*\* | -5.84\*\*\* | -6.49\*\*\* | 21.48\*\*\* | -7.28\*\*\* | 7.51\*\*\* |
|  |  |  |  |  |  |  |
| log(gdp) | -1.25 | -1.34 | -1.29 | 2.55 | -1.32 | 1.44 |
|  |  |  |  |  |  |  |
| Δlog(gdp) | -5.53\*\*\* | -5.62\*\*\* | -6.22\*\*\* | 20.82\*\*\* | -7.29\*\*\* | 7.50\*\*\* |
| Agency | -5.98\*\*\* | -6.37\*\*\* | -6.18\*\*\* | 22.36\*\*\* | -7.03\*\*\* | 7.41\*\*\* |
| Reserves | -1.31 | -1.39 | -1.35 | 2.91 | -1.37 | 1.39 |
| ΔReserves | -6.11\*\*\* | -6.42\*\*\* | -6.31\*\*\* | 22.57\*\*\* | -6.91\*\*\* | 7.24\*\*\* |

Δ denotes first differences. A constant is included in the Pesaran (2007) tests. Rejection of the null hypothesis indicates stationarity in at least one country. CIPS\* = truncated CIPS test. Both a constant and a time trend are included in the Smith et al. (2004) tests. Rejection of the null hypothesis indicates stationarity in at least one country. For both tests the results are reported at lag = 4. The null hypothesis is that of a unit root. \*\*\*: p≤0.01.

Table 3. Spreads (GMM) estimates: full sample period

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variables (1) (2)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Constant -0.074\*\* -0.063\*\*

[0.04] [0.05]

Spreads(-1) 0.233\*\*\* 0.218\*\*\*

[0.00] [0.00]

ΔBank capital to

asset ratio -0.089\*\*\* -0.077\*\*\*

[0.00] [0.00]

ΔBank capital to

asset ratio(-1) -0.064\*\*\* -0.061\*\*\*

[0.00] [0.00]

ΔNon-performing

loans to total

gross loans 0.066\*\*\* 0.058\*\*\*

[0.00] [0.00]

ΔNon-performing

loans to total

gross loans(-1) 0.050\*\*\* 0.036\*\*\*

[0.00] [0.00]

ΔNon-performing

loans to total

gross loans(-2) 0.029\*\* 0.020\*\*

[0.03] [0.05]

ΔLiquid assets to

total assets -0.061\*\*\* -0.057\*\*\*

[0.00] [0.00]

ΔLiquid assets to

total assets(-1) -0.041\*\*\* -0.036\*\*\*

[0.00] [0.01]

Risk premium

on lending 0.072\*\*\* 0.060\*\*\*

[0.00] [0.00]

Δcpi 0.053\*\*\*

[0.00]

Δcpi(-1) 0.036\*\*

[0.02]

Δgdp -0.081\*\*\*

[0.00]

Δgdp(-1) -0.057\*\*\*

[0.01]

*Diagnostics*

R2 0.59 0.68

AR(1) 0.00 0.00

AR(2) 0.38 0.41

Hansen test 0.56 0.59

Difference Hansen test 0.73 0.80

No. Of observations 910 910

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Notes: AR(1) is the first-order test for residual autocorrelation. AR(2) is the test for autocorrelation of order 2. Hansen is the test for the overidentification check for the validity of instruments. The difference-in-Hansen test checks the exogeneity of the instruments. Figures in parentheses denote p-values. \*\*: p≤0.05; \*\*\*: p≤0.01. All estimations were performed with time dummies and coefficients are not reported.

Table 4. Panel unit roots with a break

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variables LM test p-value Break date

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Spreads -0.549(2) [0.000] 2008

NIM -0.583(2) [0.000] 2008

Agency -0.552(2) [0.000] 2008

Reserves -0.731(3) [0.000] 2008

Bank capital to

asset ratio -0.601(2) [0.000] 2008

Non-performing

loans to total

gross loans -0.573(3) [0.000] 2008

Liquid assets to

total assets -0.584(2) [0.000] 2008

Risk premium

on lending -0.562(1) [0.000] 2008

log(cpi) -0.176(1) [0.136] 2009

log(gdp) -0.578(2) [0.000] 2008

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Figures in brackets denote p-values, while those in parentheses are the optimal number of lagged first-differenced terms included in the unit root test to correct for serial correlation.

Table 5. Spreads (GMM) estimates (prior and after the 2008 crisis): spreads measured as the difference between deposit and lending rates

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variables 1990-2007 2008-2015

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

constant -0.088\*\* -0.042\*\*

[0.02] [0.05]

spreads(-1) 0.202\*\*\* 0.247\*\*\*

[0.00] [0.00]

Δbank capital to

asset ratio -0.035\* -0.106\*\*\*

[0.08] [0.00]

Δbank capital to

asset ratio(-1) -0.010 -0.064\*\*\*

[0.23] [0.00]

Δnon-performing

loans to total

gross loans 0.029 0.078\*\*\*

[0.18] [0.00]

Δnon-performing

loans to total

gross loans(-1) 0.021 0.055\*\*\*

[0.30] [0.00]

Δnon-performing

loans to total

gross loans(-2) 0.013 0.041\*\*\*

[0.42] [0.00]

Δliquid assets to

total assets -0.052\*\*\* -0.063\*\*\*

[0.00] [0.00]

Δliquid assets to

total assets(-1) -0.038\*\*\* -0.047\*\*\*

[0.00] [0.00]

risk premium

on lending 0.039\* 0.089\*\*\*

[0.07] [0.00]

Δcpi 0.041\*\*\* 0.059\*\*\*

[0.00] [0.00]

Δcpi(-1) 0.033\*\* 0.041\*\*

[0.03] [0.02]

Δgdp -0.041\*\*\* -0.097\*\*\*

[0.01] [0.00]

Δgdp(-1) -0.030\*\* -0.071\*\*\*

[0.03] [0.00]

*Diagnostics*

R2 0.62 0.73

AR(1) [0.00] [0.00]

AR(2) [0.33] [0.53]

Hansen test [0.49] [0.57]

Difference Hansen test [0.62] [0.74]

Zbank capital to asset ratio [0.00]

ZΔnon-performing loans to

total gross loans [0.00]

ZΔliquid assets to total assets [0.00]

Zrisk premium on lending [0.00]

ZΔcpi [0.00]

ZΔgdp [0.00]

No. Of observations 630 280

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Notes: Similar to those in Table 3. Z is the Clogg et al. (1995) test for equality of coefficients across regime periods.

Table 6. Spreads (GMM) estimates (prior and after the 2008 crisis): spreads measured through net interest margins

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variables 1990-2007 2008-2015

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

constant -0.069\*\* -0.036\*\*

[0.03] [0.05]

NIM(-1) 0.285\*\*\* 0.338\*\*\*

[0.00] [0.00]

Δbank capital to

asset ratio -0.042\*\* -0.153\*\*\*

[0.05] [0.00]

Δbank capital to

asset ratio(-1) -0.006 -0.082\*\*\*

[0.41] [0.00]

Δnon-performing

loans to total

gross loans 0.034 0.089\*\*\*

[0.13] [0.00]

Δnon-performing

loans to total

gross loans(-1) 0.032 0.070\*\*\*

[0.24] [0.00]

Δliquid assets to

total assets -0.057\*\*\* -0.079\*\*\*

[0.00] [0.00]

Δliquid assets to

total assets(-1) -0.043\*\*\* -0.058\*\*\*

[0.00] [0.00]

risk premium

on lending 0.036\* 0.095\*\*\*

[0.08] [0.00]

Δcpi 0.045\*\*\* 0.066\*\*\*

[0.00] [0.00]

Δcpi(-1) 0.039\*\* 0.052\*\*\*

[0.02] [0.01]

Δgdp -0.048\*\*\* -0.106\*\*\*

[0.00] [0.00]

Δgdp(-1) -0.033\*\* -0.083\*\*\*

[0.02] [0.00]

*Diagnostics*

R2 0.65 0.77

AR(1) [0.00] [0.00]

AR(2) [0.31] [0.57]

Hansen test [0.52] [0.60]

Difference Hansen test [0.61] [0.69]

Zbank capital to asset ratio [0.00]

ZΔnon-performing loans to

total gross loans [0.00]

ZΔliquid assets to total assets [0.00]

Zrisk premium on lending [0.00]

ZΔcpi [0.00]

ZΔgdp [0.00]

No. Of observations 630 280

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Notes: Similar to those in Tables 3 and 5.

Table 7. Spreads (Pesaran) estimates (prior and after the 2008 crisis): spreads measured as the difference between deposit and lending rates

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Variables 1990-2007 2008-2015

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constant -0.083\*\* -0.040\*\*

[0.02] [0.05]

spreads(-1) 0.211\*\*\* 0.252\*\*\*

[0.00] [0.00]

Δbank capital to

asset ratio -0.039\* -0.110\*\*\*

[0.07] [0.00]

Δbank capital to

asset ratio(-1) -0.012 -0.068\*\*\*

[0.22] [0.00]

Δnon-performing

loans to total

gross loans 0.026 0.081\*\*\*

[0.20] [0.00]

Δnon-performing

loans to total

gross loans(-1) 0.024 0.058\*\*\*

[0.28] [0.00]

Δnon-performing

loans to total

gross loans(-2) 0.015 0.044\*\*\*

[0.41] [0.00]

Δliquid assets to

total assets -0.050\*\*\* -0.059\*\*\*

[0.00] [0.00]

Δliquid assets to

total assets(-1) -0.036\*\*\* -0.046\*\*\*

[0.00] [0.00]

risk premium

on lending 0.037\* 0.086\*\*\*

[0.07] [0.00]

Δcpi 0.043\*\*\* 0.058\*\*\*

[0.00] [0.00]

Δcpi(-1) 0.029\*\* 0.045\*\*

[0.04] [0.02]

Δgdp -0.043\*\*\* -0.101\*\*\*

[0.01] [0.00]

Δgdp(-1) -0.032\*\* -0.074\*\*\*

[0.03] [0.00]

*Diagnostics*

R2 0.61 0.74

AR(1) [0.00] [0.00]

AR(2) [0.31] [0.51]

Hansen test [0.51] [0.54]

Difference Hansen test [0.61] [0.72]

CD statistic [0.00] [0.00]

Zbank capital to asset ratio [0.00]

ZΔnon-performing loans to

total gross loans [0.00]

ZΔliquid assets to total assets [0.00]

Zrisk premium on lending [0.00]

ZΔcpi [0.00]

ZΔgdp [0.00]

No. Of observations 630 280

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Notes: CD is the Pesaran’s (2004) test for cross independence. The remaining are similar to those in Tables 3 and 5.

Table 8. Spreads (GMM) estimates (prior and after the 2008 crisis): spreads measured as the difference between deposit and lending rates-The role of agency problem

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variables 1990-2007 2008-2015

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constant -0.074\*\* -0.036\*

[0.03] [0.06]

spreads(-1) 0.216\*\*\* 0.268\*\*\*

[0.00] [0.00]

Δbank capital to

asset ratio -0.040\* -0.124\*\*\*

[0.06] [0.00]

Δbank capital to

asset ratio(-1) -0.015 -0.078\*\*\*

[0.20] [0.00]

Δnon-performing

loans to total

gross loans 0.035 0.094\*\*\*

[0.13] [0.00]

Δnon-performing

loans to total

gross loans(-1) 0.024 0.069\*\*\*

[0.27] [0.00]

Δliquid assets to

total assets -0.059\*\*\* -0.081\*\*\*

[0.00] [0.00]

Δliquid assets to

total assets(-1) -0.044\*\*\* -0.059\*\*\*

[0.00] [0.00]

risk premium

on lending 0.045\*\* 0.097\*\*\*

[0.05] [0.00]

Agency 0.068\* 0.104\*\*\*

[0.06] [0.00]

Δcpi 0.045\*\*\* 0.067\*\*\*

[0.00] [0.00]

Δcpi(-1) 0.038\*\* 0.052\*\*\*

[0.02] [0.01]

Δgdp -0.049\*\*\* -0.112\*\*\*

[0.00] [0.00]

Δgdp(-1) -0.039\*\*\* -0.082\*\*\*

[0.01] [0.00]

*Diagnostics*

R2 0.64 0.77

AR(1) [0.00] [0.00]

AR(2) [0.35] [0.59]

Hansen test [0.54] [0.61]

Difference Hansen test [0.66] [0.72]

Zbank capital to asset ratio [0.00]

ZΔnon-performing loans to

total gross loans [0.00]

ZΔliquid assets to total assets [0.00]

Zrisk premium on lending [0.00]

ZΔcpi [0.00]

ZΔgdp [0.00]

Zagency [0.00]

No. Of observations 630 280

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Notes: Similar to those in Tables 3 and 5.

Table 8a. Spreads (GMM) estimates (prior and after the 2008 crisis): spreads measured as the the difference between deposit and lending rates, while agency costs are measured as the number of non-executive directors scaled over the total board size-Robust check on the role of agency problem

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Variables 1990-2007 2008-2015

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constant -0.092\*\*\* -0.031\*

[0.01] [0.08]

spreads(-1) 0.187\*\*\* 0.294\*\*\*

[0.00] [0.00]

Δbank capital to

asset ratio -0.036\* -0.158\*\*\*

[0.08] [0.00]

Δbank capital to

asset ratio(-1) -0.010 -0.092\*\*\*

[0.35] [0.00]

Δnon-performing

loans to total

gross loans 0.031 0.116\*\*\*

[0.18] [0.00]

Δnon-performing

loans to total

gross loans(-1) 0.019 0.083\*\*\*

[0.39] [0.00]

Δliquid assets to

total assets -0.044\*\*\* -0.097\*\*\*

[0.01] [0.00]

Δliquid assets to

total assets(-1) -0.038\*\* -0.078\*\*\*

[0.02] [0.00]

risk premium

on lending 0.039\* 0.119\*\*\*

[0.07] [0.00]

Agency -0.049\* -0.138\*\*\*

[0.08] [0.00]

Δcpi 0.041\*\*\* 0.078\*\*\*

[0.00] [0.00]

Δcpi(-1) 0.034\*\* 0.060\*\*\*

[0.03] [0.00]

Δgdp -0.045\*\*\* -0.136\*\*\*

[0.00] [0.00]

Δgdp(-1) -0.035\*\*\* -0.093\*\*\*

[0.01] [0.00]

*Diagnostics*

R2 0.60 0.81

AR(1) [0.00] [0.00]

AR(2) [0.32] [0.64]

Hansen test [0.50] [0.66]

Difference Hansen test [0.59] [0.78]

Zbank capital to asset ratio [0.00]

ZΔnon-performing loans to

total gross loans [0.00]

ZΔliquid assets to total assets [0.00]

Zrisk premium on lending [0.00]

ZΔcpi [0.00]

ZΔgdp [0.00]

Zagency [0.00]

No. Of observations 630 280

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Notes: Similar to those in Tables 3 and 5.

Table 9. Spreads (GMM) estimates (prior and after the 2008 crisis): spreads measured as the difference between deposit and lending rates-The role of regulatory environment, measured as bank reserves requirements

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variables 1990-2007 2008-2015

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constant -0.068\*\* -0.039\*

[0.04] [0.06]

spreads(-1) 0.224\*\*\* 0.276\*\*\*

[0.00] [0.00]

Δbank capital to

asset ratio -0.035\* -0.116\*\*\*

[0.07] [0.00]

Δbank capital to

asset ratio(-1) -0.021 -0.072\*\*\*

[0.18] [0.00]

Δnon-performing

loans to total

gross loans 0.042 0.105\*\*\*

[0.12] [0.00]

Δnon-performing

loans to total

gross loans(-1) 0.028 0.077\*\*\*

[0.25] [0.00]

Δliquid assets to

total assets -0.053\*\*\* -0.075\*\*\*

[0.00] [0.00]

Δliquid assets to

total assets(-1) -0.040\*\*\* -0.054\*\*\*

[0.00] [0.00]

risk premium

on lending 0.039\*\* 0.083\*\*\*

[0.05] [0.00]

Reserves 0.054\* 0.186\*\*\*

[0.08] [0.00]

Δcpi 0.042\*\*\* 0.074\*\*\*

[0.00] [0.00]

Δcpi(-1) 0.035\*\* 0.057\*\*\*

[0.02] [0.00]

Δgdp -0.053\*\*\* -0.124\*\*\*

[0.00] [0.00]

Δgdp(-1) -0.042\*\*\* -0.089\*\*\*

[0.01] [0.00]

*Diagnostics*

R2 0.62 0.79

AR(1) [0.00] [0.00]

AR(2) [0.31] [0.53]

Hansen test [0.58] [0.69]

Difference Hansen test [0.58] [0.64]

Zbank capital to asset ratio [0.00]

ZΔnon-performing loans to

total gross loans [0.00]

ZΔliquid assets to total assets [0.00]

Zrisk premium on lending [0.00]

ZΔcpi [0.00]

ZΔgdp [0.00]

Zreserves [0.00]

No. Of observations 630 280

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Notes: Similar to those in Tables 3 and 5.

Table 10. Spreads (GMM) estimates (prior and after the 2008 crisis): spreads measured as the difference between deposit and lending rates-The role of regulatory environment measured as the Rules of Law

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Variables 1990-2007 2008-2015

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constant -0.049\* -0.031\*

[0.06] [0.09]

spreads(-1) 0.207\*\*\* 0.299\*\*\*

[0.00] [0.00]

Δbank capital to

asset ratio -0.030\* -0.135\*\*\*

[0.09] [0.00]

Δbank capital to

asset ratio(-1) -0.014 -0.088\*\*\*

[0.27] [0.00]

Δnon-performing

loans to total

gross loans 0.034 0.129\*\*\*

[0.20] [0.00]

Δnon-performing

loans to total

gross loans(-1) 0.022 0.092\*\*\*

[0.37] [0.00]

Δliquid assets to

total assets -0.041\*\* -0.086\*\*\*

[0.02] [0.00]

Δliquid assets to

total assets(-1) -0.028\*\* -0.071\*\*\*

[0.05] [0.00]

risk premium

on lending 0.033\* 0.096\*\*\*

[0.07] [0.00]

Rules of Law -0.039\* -0.209\*\*\*

[0.10] [0.00]

Δcpi 0.039\*\*\* 0.082\*\*\*

[0.01] [0.00]

Δcpi(-1) 0.032\*\* 0.068\*\*\*

[0.03] [0.00]

Δgdp -0.046\*\*\* -0.129\*\*\*

[0.00] [0.00]

Δgdp(-1) -0.033\*\*\* -0.094\*\*\*

[0.01] [0.00]

*Diagnostics*

R2 0.65 0.81

AR(1) [0.00] [0.00]

AR(2) [0.28] [0.47]

Hansen test [0.52] [0.64]

Difference Hansen test [0.49] [0.69]

Zbank capital to asset ratio [0.00]

ZΔnon-performing loans to

total gross loans [0.00]

ZΔliquid assets to total assets [0.00]

Zrisk premium on lending [0.00]

ZΔcpi [0.00]

ZΔgdp [0.00]

ZRules of Law [0.00]

No. Of observations 630 280

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Notes: Similar to those in Tables 3, 5 and 9.

1. Friedman and Kuttner (1998) find that movements in the interest rate spread in the years just prior to the1990-1991 recession was influenced by changes in the quantities of commercial paper, bank CDs, and Treasury bills that were not related to the business cycle. Hanweck and Ryu (2005) find that for most banks changes in net interest are sensitive to credit, the interest-rate, and term-structure shocks but to different degrees. Bernanke (1990) investigates the predictive power of spreads. [↑](#footnote-ref-1)